Exhibit 2

US6661783	Endress+Hauser's Fieldgate FXA42 ("The accused product")
3. A spreading code selection method, which selects as the spreading code for asymmetric communications, a hierarchic orthogonal type spreading code which is a spreading code of a hierarchy which contains spreading codes of a longer length than spreading codes used for symmetric communication lines and is orthogonal to spreading codes used for other asymmetric communication lines.	The accused product, at least in internal testing and usage, practices selecting as the spreading code (e.g., OVSF code as channelization code) for asymmetric communications, a hierarchic orthogonal type spreading code (e.g., hierarchical OVSF codes) which is a spreading code of a hierarchy which contains spreading codes of a longer length than spreading codes used for symmetric communication lines and is orthogonal to spreading codes used for other asymmetric communication lines. As shown below, different users in UMTS-FDD use different spreading codes which are mutually orthogonal and therefore spreading codes for asymmetric communication line between a user and a base station and that of another user and the base station respectively happen to be orthogonal. The accused product is equipped with 3G (also referred to as UMTS). 3G/UMTS has UMTS-FDD as one of its variants.

	# Gateway for measurement values Fieldgate FXA42  Communication of measurement values of connected 4 to 20mA analog as well as digital field devices Fieldgate FXA42 is developed for monitoring of field devices with digital or 4 to 20mA interface regardless of location. It supports communication interfaces like Ethernet, WLAN or cellular communication. With its integrated web server technology it can easily be configured online and measured values can be visualized online. FXA42 also offers data logging and alarm management functions. Sizing Compare Pricing after login and configuration https://www.us.endress.com/en/field-instruments-overview/system-components-recorder-data-manager/Gateway-Fieldgate-FXA42

Application

Fieldgates make it possible to remotely interrogate connected 4 to 20 mA, Modbus RS485 and Modbus TCP devices, either via Ethernet TCP/IP, WLAN or mobile telecommunications (UMTS). The measured data are processed accordingly and can be evaluated in the Web browser without any additional software. Advanced automation capabilities are available, such as an integrated Web-PLC, OpenVPN and other functions.

Your benefits

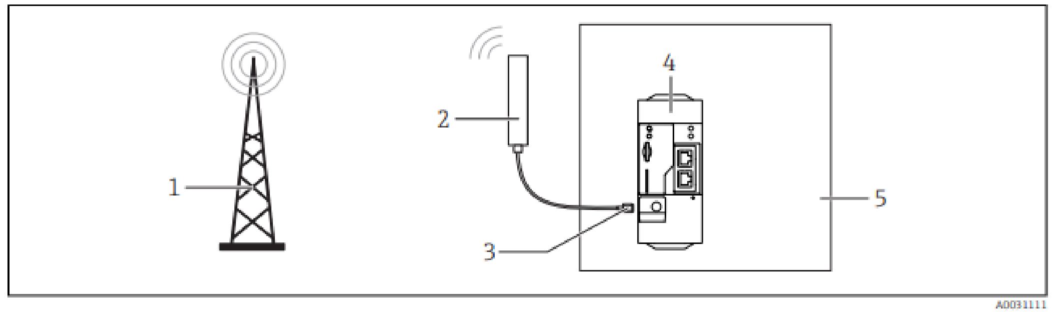
- Communication via Ethernet, WLAN or UMTS
- Easy configuration with Web browser, no add-on software
- Four 4 to 20 mA current inputs with integrated loop power supply
- Active/passive current input for 2-wire and 4-wire devices
- Four digital inputs can also be used as pulse counters for flow applications.
- Advanced logic functions thanks to integrated Web-PLC and communication with external systems via Modbus interface.

https://portal.endress.com/wa001/dla/5001060/7284/000/00/TI01297SEN_0116.pdf

Antenna

The Fieldgates FXA42 require an external antenna for wireless communication via UMTS (2G/3G) and WLAN. The antenna can be purchased as an accessory from Endress+Hauser. The antenna cable is screwed onto the connection on the front of the Fieldgate. The antenna must be mounted outside the cabinet or field housing. In areas with weak UMTS (2G/3G) or WLAN reception, it is advisable to first check the communication before securing the antenna permanently.

Connection: SMA connection.



1 UMTS (2G/3G) network
2 Antenna for Fieldgate FXA42
3 SMA connection
4 Fieldgate FXA42 Ethernet and 2G/3G
5 Control cabinet

https://portal.endress.com/wa001/dla/5001060/7284/000/00/TI01297SEN_0116.pdf

	UMTS – It's not just about radio UMTS is not just about radio: the radio access network connects to the core network which is an evolution from the GSM core. 3GPP has expanded its capabilities, in principle allowing most services to be delivered over either 2G GERAN (GSM/EDGE) or 3G UTRAN. The core network is becoming progressively access-agnostic, allowing home base stations serving pica-cells to connect directly to the core network via subscribers' ASDL lines. 3GPP is now working on Long Term Evolution (LTE), which will build on UMTS, as the Industry looks beyond 3G. Just as GSM has become synonymous with the whole mobile system for 2G, UMTS is 3G, which includes the whole of the W-CDMA and HSPA specifications catalogue. https://www.3gpp.org/technologies/keywords-acronyms/103-umts **UMTS** **Universal Mobile Telecommunications System** UMTS is an umbrella term for the third generation radio technologies developed within 3GPP. The radio access specifications provide for Frequency Division Duplex (FDD) and Time Division Duplex (TDD) variants, and several chip rates are provided for in the TDD option, allowing UTRA technology to operate in a wide range of bands and co-exist with other radio access technologies. UMTS includes the original W-CDMA scheme using paired or unpaired 5 MHz wide channels in globally agreed bandwidth around 2 GHz, though subsequently, further bandwidth has been allocated by the ITU on a regional basis. https://www.3gpp.org/technologies/keywords-acronyms/103-umts

3G UMTS frequency bands - FDD

As FDD, frequency division duplex requires bands for uplink and downlink, the bands for FDD are different to those required for TDD time division duplex.

The main UMTS / WCDMA frequency bands for FDD operation are summarised below:

3G UMTS FREQUENCY BANDS - FDD

BAND NUMBER	BAND	COMMON NAME	UL FREQUENCIES	DL FREQUENCUES
1	2100	IMT	1920 - 1980	2120 - 2170
2	1900	PCS A-F	1850 - 1910	1930 - 1990
3	1800	DCS	1710 - 1785	1805 - 1880
4	1700	AWS A-F	1710 - 1755	2110 - 2155
5	850	CLR	824 - 849	869 - 894
6	800		830 - 840	875 - 885
7	2600	IMT-E	2500 - 2570	2620 - 2690
8	900	E-GSM	880 - 915	925 - 960
9	1700		1749.9 - 1784.9	1844.9 - 1879.9
10	1700	EAWS A-G	1710 - 1770	2110 - 2170
11	1500	LPDC	1427.9 - 1447.9	1475.9 - 1495.9
12	700	LSMH	699 - 716	729 - 746
13	700	USMH C	777 - 787	746 - 756
14	700	USMH D	788 - 798	758 - 768
19	800		832.4 - 842.6	877.4 - 887.6
20	800	EUDD	832 - 862	791 - 821
21	1500	UPDC	1447.9 - 1462.9	1495 - 1510.9

https://www.electronics-notes.com/articles/connectivity/3g-umts/frequency-bands-channels-uarfcn.php

	What is 3G UMTS: WCDMA Tutorial *3G UMTS using WCDMA technology is a third generation mobile telecommunications system run under the auspices of 3GPP providing mobile data connectivity & circuit switched voice.* **3G UMTS includes:** What is UMTS Network architecture Radio access Radio interface Frequency bands UMTS CDMA Modulation Data channels UMTS TDD TD-SDCDMA Handover UMTS - Universal Mobile Telecommunications System, is the 3G successor to the GSM family of standards including GPRS and EDGE. 3G UMTS uses a totally different radio interface based around the use of Direct Sequence Spread Spectrum as CDMA or Code Division Multiple Access. Although 3G UMTS uses a totally different radio access standard, the core network is the same as that used for GPRS and EDGE to carry separate circuit switched voice and packet data. UMTS uses a wideband version of CDMA occupying a 5 MHz wide channel. Being wider than its competition CDMA2000 which only used a 1.25MHz channel, the modulation scheme was known as wideband CDMA, or WCDMA / W-CDMA. This name was often used to refer to the whole system. https://www.electronics-notes.com/articles/connectivity/3g-umts/what-is-umts-wcdma-tutorial.php

	 3G UMTS capabilities UMTS uses Wideband CDMA - WCDMA - as the radio transmission standard. It employs a 5 MHz channel bandwidth. Using this bandwidth it has the capacity to carry over 100 simultaneous voice calls, or it is able to carry data at speeds up to 2 Mbps in its original format. However with the later enhancements of HSDPA and HSUPA (described in other articles accessible from the cellular telecommunications menu page) included in later releases of the standard the data transmission speeds have been increased to 14.4 Mbps. Many of the ideas that were incorporated into GSM have been carried over and enhanced for UMTS. Elements such as the SIM have been transformed into a far more powerful USIM (Universal SIM). In addition to this, the network has been designed so that the enhancements employed for GPRS and EDGE can be used for UMTS. In this way the investment required is kept to a minimum. A new introduction for UMTS is that there are specifications that allow both Frequency Division Duplex (FDD) and Time Division Duplex (TDD) modes. The first modes to be employed are FDD modes where the uplink and downlink are on different frequencies. The spacing between them is 190 MHz for Band 1 networks being currently used and rolled out. https://www.electronics-notes.com/articles/connectivity/3g-umts/what-is-umts-wcdma-tutorial.php

Main UMTS Codes

Here us a summary of the main UMTS FDD codes:

	Synchronisation Codes	Channelisation Codes	Scrambling Codes, UL	Scrambling Codes, DL
Type	Gold Codes Primary Synchronization Codes (PSC) and Secondary Synchronization Codes (SSC)	Orthogonal Variable Spreading Factor (OVSF) codes sometimes called Walsh Codes	Complex-Valued Gold Code Segments (long) or Complex-Valued S(2) Codes (short) Pseudo Noise (PN) codes	Complex-Valued Gold Code Segments Pseudo Noise (PN) codes
Length	256 chips	4-512 chips	38400 chips / 256 chips	38400 chips
Duration	66.67 µs	1.04 µs - 133.34 µs	10 ms / 66.67 µs	10 ms
Number of codes	1 primary code / 16 secondary codes	= spreading factor 4 ... 256 UL, 4 ... 512 DL	16,777,216	512 primary / 15 secondary for each primary code
Spreading	No, does not change bandwidth	Yes, increases bandwidth	No, does not change bandwidth	No, does not change bandwidth
Usage	To enable terminals to locate and synchronise to the cells' main control channels	UL: to separate physical data and control data from same terminal DL: to separate connection to different terminals	Separation of terminal	Separation of sectors

https://www.umtsworld.com/technology/codes.htm

4.3 Code generation and allocation

4.3.1 Channelisation codes

4.3.1.1 Code definition

The channelisation codes of figure 1 are Orthogonal Variable Spreading Factor (OVSF) codes that preserve the orthogonality between a user's different physical channels. The OVSF codes can be defined using the code tree of figure 4.

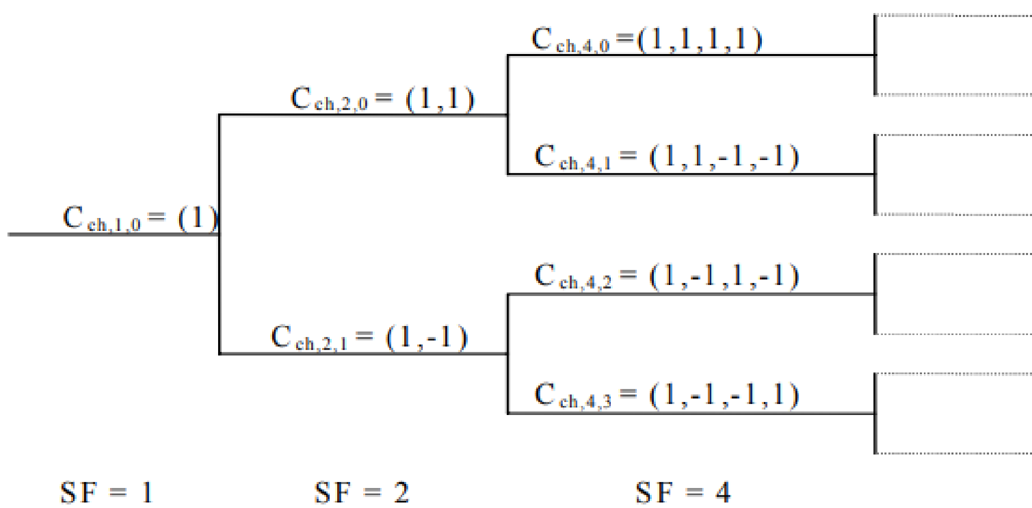


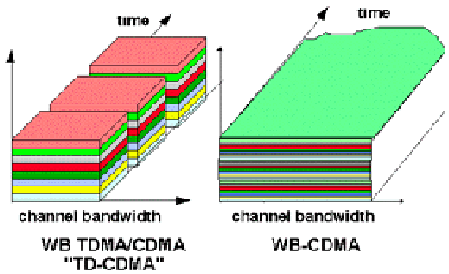
Figure 4: Code-tree for generation of Orthogonal Variable Spreading Factor (OVSF) codes

https://www.etsi.org/deliver/etsi_ts/125200_125299/125213/06.00.00_60/ts_125213v060000p.pdf

	The spreading code for the downlink of asymmetric communications and said longer spreading code is orthogonal to spreading codes used for other asymmetric communication lines (e.g., Orthogonal Variable Spreading Factor (OVSF) codes). In the FDD (Frequency Division Duplex) mode the spreading factors (e.g., spreading code length) are from 256 to 2 for uplink and from 512 to 4 for downlink.

WCDMA (UMTS)

Wideband Code-Division Multiple-Access (W-CDMA) is one of the main technologies for the implementation of third-generation (3G) cellular systems. It is base on radio access technique proposed by ETSI Alpha group and the specifications was finalised 1999.



The implementation of W-CDMA will be a technical challenge because of it's complexity and versatility. The complexity of W-CDMA systems can be viewed from different angles: the complexity of each single algorithm, the complexity of the overall system and the computational complexity of a receiver. W-CDMA link-level simulations are over 10 times more compute-intensive than current second-generation simulations. In W-CDMA interface different users can simultaneously transmit at different data rates and data rates can even vary in time. UMTS networks need to support all current second generation services and numerous new applications and services.

FDD Technical summary

Frequency band:1920 MHz -1980 MHz and 2110 MHz - 2170 MHz (Frequency Division Duplex) UL and DL [more]
Minimum frequency band required: ~ 2x5MHz
Frequency re-use: 1
Carrier Spacing: 4.4MHz - 5.2 MHz
Maximum number of (voice) channels on 2x5MHz: ~196 (spreading factor 256 UL, AMR 7.95kbps) / ~98 (spreading factor 128 UL, AMR 12.2kbps)
Voice coding: AMR codecs (4.75 kHz - 12.2 kHz, GSM EFR=12.2 kHz) and SID (1.8 kHz)
Channel coding: Convolutional coding, Turbo code for high rate data
Duplexer needed (190MHz separation), Asymmetric connection supported

https://www.umtsworld.com/technology/wcdma.htm

	The information rate of the channel varies with the symbol rate being derived from the 3.84 Mcps chip rate and the spreading factor. Spreading factors are from 256 to 2 with FDD uplink, from 512 to 4 with FDD downlink, and from 16 to 1 for TDD uplink and downlink. Thus the respective modulation symbol rates vary from 1920 k symbols/s to 15 k symbols/s (7.5 k symbols/s) for FDD uplink (downlink), and for TDD the momentary modulation symbol rates shall vary from 3.84 M symbols/s to 240 k symbols/s. https://www.etsi.org/deliver/etsi_TS/125200_125299/125201/07.03.00_60/ts_125201v070300p.pdf
4. A CDMA mobile communication method, when performing asymmetric communications, comprising:	The accused product practices a CDMA mobile communication method (e.g., WCDMA) for asymmetric communication. The accused product utilizes UMTS-FDD technology using WCDMA technology.

Gateway for measurement values Fieldgate FXA42

Communication of measurement values of connected 4 to 20mA analog as well as digital field devices

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Sizing

Compare

Pricing after login and configuration

https://www.us.endress.com/en/field-instruments-overview/system-components-recorder-data-manager/Gateway-Fieldgate-FXA42

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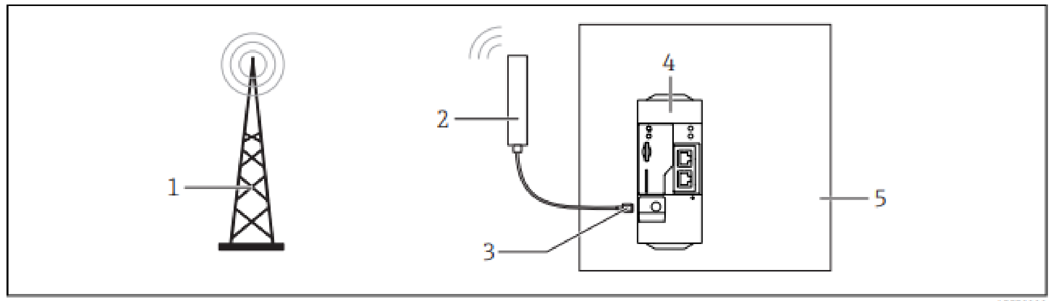
	Antenna The Fieldgates FXA42 require an external antenna for wireless communication via UMTS (2G/3G) and WLAN. The antenna can be purchased as an accessory from Endress+Hauser. The antenna cable is screwed onto the connection on the front of the Fieldgate. The antenna must be mounted outside the cabinet or field housing. In areas with weak UMTS (2G/3G) or WLAN reception, it is advisable to first check the communication before securing the antenna permanently. Connection: SMA connection.  A0031111 *1 UMTS (2G/3G) network* *2 Antenna for Fieldgate FXA42* *3 SMA connection* *4 Fieldgate FXA42 Ethernet and 2G/3G* *5 Control cabinet* https://portal.endress.com/wa001/dla/5001060/7284/000/00/TI01297SEN_0116.pdf

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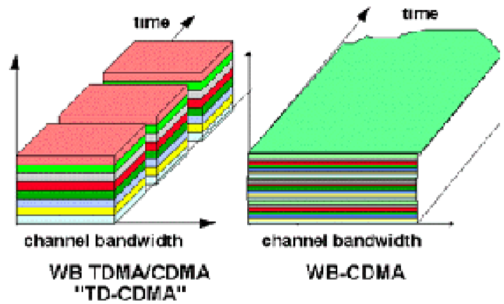
	WCDMA (UMTS) Wideband Code-Division Multiple-Access (W-CDMA) is one of the main technologies for the implementation of third-generation (3G) cellular systems. It is base on radio access technique proposed by ETSI Alpha group and the specifications was finalised 1999.  The implementation of W-CDMA will be a technical challenge because of it's complexity and versatility. The complexity of W-CDMA systems can be viewed from different angles: the complexity of each single algorithm, the complexity of the overall system and the computational complexity of a receiver. W-CDMA link-level simulations are over 10 times more compute-intensive than current second-generation simulations. In W-CDMA interface different users can simultaneously transmit at different data rates and data rates can even vary in time. UMTS networks need to support all current second generation services and numerous new applications and services. FDD Technical summary **Frequency band:**1920 MHz -1980 MHz and 2110 MHz - 2170 MHz (Frequency Division Duplex) UL and DL [more] **Minimum frequency band required:** ~ 2x5MHz **Frequency re-use:** 1 **Carrier Spacing:** 4.4MHz - 5.2 MHz **Maximum number of (voice) channels on 2x5MHz:** ~196 (spreading factor 256 UL, AMR 7.95kbps) / ~98 (spreading factor 128 UL, AMR 12.2kbps) **Voice coding:** AMR codecs (4.75 kHz - 12.2 kHz, GSM EFR=12.2 kHz) and SID (1.8 kHz) **Channel coding:** Convolutional coding, Turbo code for high rate data Duplexer needed (190MHz separation), Asymmetric connection supported https://www.umtsworld.com/technology/wcdma.htm

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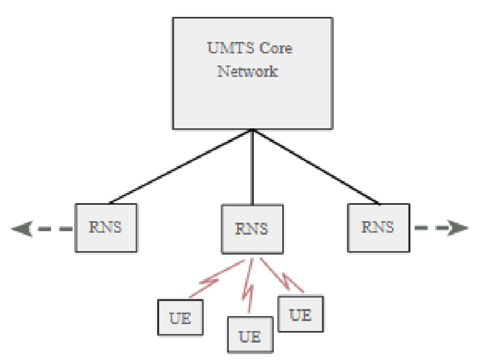
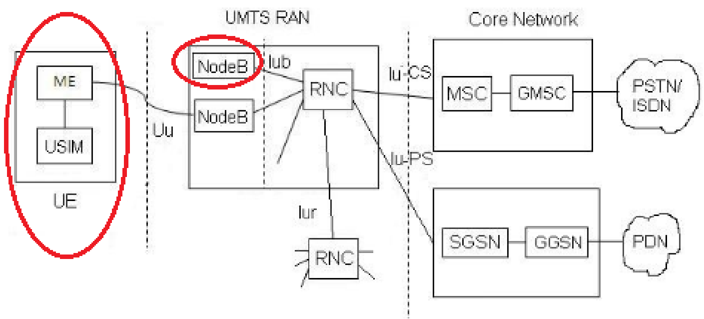
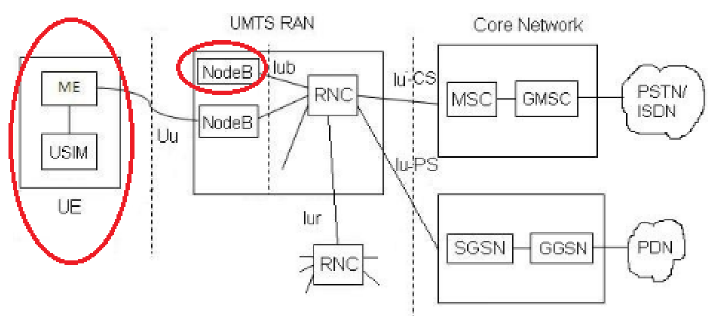
	3G UMTS / WCDMA technologies There are several key areas of 3G UMTS / WCDMA. Within these there are several key technologies that have been employed to enable UMTS / WCDMA to provide a leap in performance over its 2G predecessors. Some of these key areas include: • ***Radio interface:*** The UMTS radio interface provides the basic definition of the radio signal. W-CDMA occupies 5 MHz channels and has defined formats for elements such as synchronisation, power control and the like • ***CDMA technology :*** 3G UMTS relies on a scheme known as CDMA or code divison multiple access to enable multiple handsets or user equipments to have access to the base station. Using a scheme known as direct sequence spread spectrum, different UEs have different codes and can all talk to the base station even though they are all on the same frequency • ***UMTS network architecture:*** The architecture for a UMTS network was designed to enable packet data to be carried over the network, whilst still enabling it to support circuit switched voice. All the usual functions enabling access toth e network, roaming and the like are also supported. • ***UMTS modulation schemes:*** Within the CDMA signal format, a variety of forms of modulation are used. These are typically forms of phase shift keying. • ***UMTS channels:*** As with any cellular system, different data channels are required for passing payload data as well as control information and for enabling the required resources to be allocated. A variety of different data channels are used to enable these facilities to be accomplished. https://www.electronics-notes.com/articles/connectivity/3g-umts/network-architecture.php

	## 3G UMTS network constituents The UMTS network architecture can be divided into three main elements: • *User Equipment (UE):* The User Equipment or UE is the name given to what was previous termed the mobile, or cellphone. The new name was chosen because the considerably greater functionality that the UE could have. It could also be anything between a mobile phone used for talking to a data terminal attached to a computer with no voice capability. • *Radio Network Subsystem (RNS):* The RNS also known as the UMTS Radio Access Network, UTRAN, is the equivalent of the previous Base Station Subsystem or BSS in GSM. It provides and manages the air interface fort he overall network. • *Core Network:* The core network provides all the central processing and management for the system. It is the equivalent of the GSM Network Switching Subsystem or NSS. The core network is then the overall entity that interfaces to external networks including the public phone network and other cellular telecommunications networks.  The main UMTS network blocks https://www.electronics-notes.com/articles/connectivity/3g-umts/network-architecture.php

	UMTS Network Architecture  http://www.rfwireless-world.com/Tutorials/UMTS-Network-Architecture.html As shown below, in the case of UMTS-FDD based communication, spreading factors range from 256 to 2 in the uplink direction and 512 to 4 in the downlink direction, thereby providing different symbols rates per second for uplink and downlink respectively. **4.2 General description of Layer 1** **4.2.1 Multiple Access** The access scheme is Direct-Sequence Code Division Multiple Access (DS-CDMA) with information either spread over approximately 5 MHz (FDD and 3.84 Mcps TDD) bandwidth, thus also often denoted as Wideband CDMA (WCDMA) due that nature, 10MHz (7.68 Mcps TDD) bandwidth, or 1.6MHz (1.28Mcps TDD), thus also often denoted as Narrowband CDMA. UTRA has two modes, FDD (Frequency Division Duplex) & TDD (Time Division Duplex), for operating with paired and unpaired bands respectively. The possibility to operate in either FDD or TDD mode allows for efficient utilisation of the available spectrum according to the frequency allocation in different regions. FDD and TDD modes are defined as follows: FDD: A duplex method whereby uplink and downlink transmissions use two separated radio frequencies. In the FDD, each uplink and downlink uses the different frequency band. A pair of frequency bands which have specified separation shall be assigned for the system. TDD: A duplex method whereby uplink and downlink transmissions are carried over same radio frequency by using synchronised time intervals. In the TDD, time slots in a physical channel are divided into transmission and reception part. Information on uplink and downlink are transmitted reciprocally. https://www.etsi.org/deliver/etsi_TS/125200_125299/125201/07.03.00_60/ts_125201v070300p.pdf

	The information rate of the channel varies with the symbol rate being derived from the 3.84 Mcps chip rate and the spreading factor. Spreading factors are from 256 to 2 with FDD uplink, from 512 to 4 with FDD downlink, and from 16 to 1 for TDD uplink and downlink. Thus the respective modulation symbol rates vary from 1920 k symbols/s to 15 k symbols/s (7.5 k symbols/s) for FDD uplink (downlink), and for TDD the momentary modulation symbol rates shall vary from 3.84 M symbols/s to 240 k symbols/s. https://www.etsi.org/deliver/etsi_TS/125200_125299/125201/07.03.00_60/ts_125201v070300p.pdf
a base station apparatus spreading known reference signals and transmission power control bits by spreading codes with a length that is longer than spreading codes used for symmetric communications, and transmitting spreaded known reference signals and a spreaded transmission power control bits at a lower transmission rate than a transmission rate when symmetric communications are performed;	The accused product, at least in internal testing and usage, utilizes a base station (e.g., NodeB). The base station (e.g., NodeB) practices spreading known reference signals (e.g., RSCP signals) and transmission power control bits (e.g, bits of TPC_cmd) by spreading codes with a length that is longer than spreading codes used for symmetric communications, and transmitting spreaded known reference signals (e.g., RSCP signals) and a spreaded transmission power control bits (e.g., bits of TPC_cmd) at a lower transmission rate than a transmission rate when symmetric communications are performed. UMTS Network Architecture  http://www.rfwireless-world.com/Tutorials/UMTS-Network-Architecture.html For symmetric communication, the data rate (and its corresponding associated spreading factor) of the uplink and downlink are the same. They therefore have the same spreading factor whereas in case of asymmetric communication there is a difference in the uplink and downlink data rates (and its corresponding associated spreading factor) which will thereby process a higher spreading factor for downlink communication.

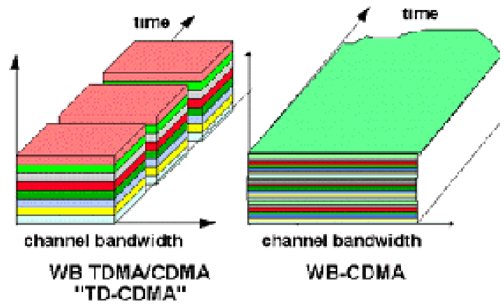
	Higher the spreading code for downlink communication lower the data rate (e.g., code length or spreading factor of 4 gives data rate of 960 Kbits/sec whereas code length or spreading factor of 512 gives 7.5 Kbits/sec) therefore asymmetric communications, transmits known reference signals (e.g., RS signal) and transmission power control bits (e.g., TPC bits) at a lower transmission rate than a transmission rate when symmetric communications are performed. The information rate of the channel varies with the symbol rate being derived from the 3.84 Mcps chip rate and the spreading factor. Spreading factors are from 256 to 2 with FDD uplink, from 512 to 4 with FDD downlink, and from 16 to 1 for TDD uplink and downlink. Thus the respective modulation symbol rates vary from 1920 k symbols/s to 15 k symbols/s (7.5 k symbols/s) for FDD uplink (downlink), and for TDD the momentary modulation symbol rates shall vary from 3.84 M symbols/s to 240 k symbols/s. https://www.etsi.org/deliver/etsi_TS/125200_125299/125201/07.03.00_60/ts_125201v070300p.pdf **5.1.1 CPICH RSCP** <table><tr><td>**Definition**</td><td>Received Signal Code Power, the received power on one code measured on the Primary CPICH. The reference point for the RSCP shall be the antenna connector of the UE. If Tx diversity is applied on the Primary CPICH the received code power from each antenna shall be separately measured and summed together in [W] to a total received code power on the Primary CPICH.</td></tr><tr><td>**Applicable for**</td><td>Idle, URA_PCH intra, URA_PCH inter, CELL_PCH intra, CELL_PCH inter, CELL_FACH intra, CELL_FACH inter, CELL_DCH intra, CELL_DCH inter</td></tr></table> https://www.etsi.org/deliver/etsi_ts/125200_125299/125215/06.03.00_60/ts_125215v060300p.pdf

	9.1 Measurement Performance for UE The requirements in this clause are applicable for a UE: - in state CELL_DCH and/or state CELL_FACH. - performing measurements according to section 8. - that is synchronised to the cell that is measured. The reported measurement result after layer 1 filtering shall be an estimate of the average value of the measured quantity over the measurement period. The reference point for the measurement result after layer 1 filtering is referred to as point B in the measurement model described in TS25.302. The accuracy requirements in this clause are valid for the reported measurement result after layer 1 filtering. The accuracy requirements are verified from the measurement report at point D in the measurement model having the layer 3 filtering disabled. Note: It needs to be clarified how the accuracy requirements shall be handled when the UE is measuring on cells using IPDL. **9.1.1 CPICH RSCP** Note: This measurement is for handover evaluation, DL open loop power control, UL open loop power control and for the calculation of pathloss. https://www.etsi.org/deliver/etsi_ts/125100_125199/125133/06.04.00_60/ts_125133v060400p.pdf

	## 2 References The following documents contain provisions which, through reference in this text, constitute provisions of the present document. • References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific. • For a specific reference, subsequent revisions do not apply. • For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*. [1] 3GPP TS 25.211: "Physical channels and mapping of transport channels onto physical channels (FDD)". [2] 3GPP TS 25.212: "Multiplexing and channel coding (FDD)". [3] 3GPP TS 25.213: "Spreading and modulation (FDD)". [4] 3GPP TS 25.214: "Physical layer procedures (FDD)". [5] 3GPP TS 25.215: "Physical layer – Measurements (FDD)". [6] 3GPP TS 25.221: "Physical channels and mapping of transport channels onto physical channels (TDD)". https://www.etsi.org/deliver/etsi_TS/125200_125299/125201/07.03.00_60/ts_125201v070300p.pdf ## 5.6 TS 25.214: Physical layer procedures (FDD) The scope is to establish the characteristics of the physical layer procedures in the FDD mode, and to specify: - cell search procedures; - power control procedures; - random access procedure. https://www.etsi.org/deliver/etsi_TS/125200_125299/125201/07.03.00_60/ts_125201v070300p.pdf

	5.1.2.2.1.2 TPC command generation on downlink during RL initialisation When commanded by higher layers the TPC commands sent on a downlink radio link from Node Bs that have not yet achieved uplink synchronisation shall follow a pattern as follows: If higher layers indicate by "First RLS indicator" that the radio link is part of the first radio link set sent to the UE and the value 'n' obtained from the parameter "DL TPC pattern 01 count" passed by higher layers is different from 0 then : - the TPC pattern shall consist of n instances of the pair of TPC commands ("0" ,"1"), followed by one instance of TPC command "1", where ("0","1") indicates the TPC commands to be transmitted in 2 consecutive slots, - the TPC pattern continuously repeat but shall be forcibly re-started at the beginning of each frame where CFN mod 4 = 0. ***ETSI*** **3GPP TS 25.214 version 6.11.0 Release 6 16 ETSI TS 125 214 V6.11.0 (2006-12)** else - The TPC pattern shall consist only of TPC commands "1". The TPC pattern shall terminate once uplink synchronisation is achieved. https://www.etsi.org/deliver/etsi_ts/125200_125299/125214/06.11.00_60/ts_125214v061100p.pdf

	5.1.2.2.2.3 Combining of TPC commands from radio links of different radio link sets This subclause describes the general scheme for combination of the TPC commands from radio links of different radio link sets. First, the UE shall conduct a soft symbol decision W_i on each of the power control commands TPC_i, where i = 1, 2, …, N, where N is greater than 1 and is the number of TPC commands from radio links of different radio link sets, that may be the result of a first phase of combination according to subclause 5.1.2.2.2.2. Finally, the UE derives a combined TPC command, TPC_cmd, as a function γ of all the N soft symbol decisions W_i: - TPC_cmd = γ (W_1, W_2, … W_N), where TPC_cmd can take the values 1 or -1. The function γ shall fulfil the following criteria: If the N TPC_i commands are random and uncorrelated, with equal probability of being transmitted as "0" or "1", the probability that the output of γ is equal to 1 shall be greater than or equal to $1/(2^N)$, and the probability that the output of γ is equal to -1 shall be greater than or equal to 0.5. Further, the output of γ shall equal 1 if the TPC commands from all the radio link sets are reliably "1", and the output of γ shall equal –1 if a TPC command from any of the radio link sets is reliably "0". https://www.etsi.org/deliver/etsi_ts/125200_125299/125214/06.11.00_60/ts_125214v061100p.pdf The spreading code for the downlink of asymmetric communications and said longer spreading code is orthogonal to spreading codes used for other asymmetric communication lines (e.g., Orthogonal Variable Spreading Factor (OVSF) codes). In the FDD (Frequency Division Duplex) mode the spreading factors (e.g., spreading code length) are from 256 to 2 for uplink and from 512 to 4 for downlink.

	WCDMA (UMTS) Wideband Code-Division Multiple-Access (W-CDMA) is one of the main technologies for the implementation of third-generation (3G) cellular systems. It is base on radio access technique proposed by ETSI Alpha group and the specifications was finalised 1999.  The implementation of W-CDMA will be a technical challenge because of it's complexity and versatility. The complexity of W-CDMA systems can be viewed from different angles: the complexity of each single algorithm, the complexity of the overall system and the computational complexity of a receiver. W-CDMA link-level simulations are over 10 times more compute-intensive than current second-generation simulations. In W-CDMA interface different users can simultaneously transmit at different data rates and data rates can even vary in time. UMTS networks need to support all current second generation services and numerous new applications and services. FDD Technical summary **Frequency band:**1920 MHz -1980 MHz and 2110 MHz - 2170 MHz (Frequency Division Duplex) UL and DL [more] **Minimum frequency band required:** ~ 2x5MHz **Frequency re-use:** 1 **Carrier Spacing:** 4.4MHz - 5.2 MHz **Maximum number of (voice) channels on 2x5MHz:** ~196 (spreading factor 256 UL, AMR 7.95kbps) / ~98 (spreading factor 128 UL, AMR 12.2kbps) **Voice coding:** AMR codecs (4.75 kHz - 12.2 kHz, GSM EFR=12.2 kHz) and SID (1.8 kHz) **Channel coding:** Convolutional coding, Turbo code for high rate data Duplexer needed (190MHz separation), Asymmetric connection supported https://www.umtsworld.com/technology/wcdma.htm

	The information rate of the channel varies with the symbol rate being derived from the 3.84 Mcps chip rate and the spreading factor. Spreading factors are from 256 to 2 with FDD uplink, from 512 to 4 with FDD downlink, and from 16 to 1 for TDD uplink and downlink. Thus the respective modulation symbol rates vary from 1920 k symbols/s to 15 k symbols/s (7.5 k symbols/s) for FDD uplink (downlink), and for TDD the momentary modulation symbol rates shall vary from 3.84 M symbols/s to 240 k symbols/s. https://www.etsi.org/deliver/etsi_TS/125200_125299/125201/07.03.00_60/ts_125201v070300p.pdf
a mobile station apparatus receiving said transmission power control bits; and	The accused product practices receiving said transmission power control bits (e.g., bits of TPC_cmd). **5.6 TS 25.214: Physical layer procedures (FDD)** The scope is to establish the characteristics of the physical layer procedures in the FDD mode, and to specify: - cell search procedures; - power control procedures; - random access procedure. https://www.etsi.org/deliver/etsi_TS/125200_125299/125201/07.03.00_60/ts_125201v070300p.pdf

	5.1.2.2.1.2 TPC command generation on downlink during RL initialisation When commanded by higher layers the TPC commands sent on a downlink radio link from Node Bs that have not yet achieved uplink synchronisation shall follow a pattern as follows: If higher layers indicate by "First RLS indicator" that the radio link is part of the first radio link set sent to the UE and the value 'n' obtained from the parameter "DL TPC pattern 01 count" passed by higher layers is different from 0 then : - the TPC pattern shall consist of n instances of the pair of TPC commands ("0" ,"1"), followed by one instance of TPC command "1", where ("0","1") indicates the TPC commands to be transmitted in 2 consecutive slots, - the TPC pattern continuously repeat but shall be forcibly re-started at the beginning of each frame where CFN mod 4 = 0. *ETSI* **3GPP TS 25.214 version 6.11.0 Release 6 16 ETSI TS 125 214 V6.11.0 (2006-12)** else - The TPC pattern shall consist only of TPC commands "1". The TPC pattern shall terminate once uplink synchronisation is achieved. https://www.etsi.org/deliver/etsi_ts/125200_125299/125214/06.11.00_60/ts_125214v061100p.pdf

<table>
<tr><td></td><td>
5.1.2.2.2.3 Combining of TPC commands from radio links of different radio link sets

This subclause describes the general scheme for combination of the TPC commands from radio links of different radio link sets.

First, the UE shall conduct a soft symbol decision W_i on each of the power control commands TPC_i, where i = 1, 2, …, N, where N is greater than 1 and is the number of TPC commands from radio links of different radio link sets, that may be the result of a first phase of combination according to subclause 5.1.2.2.2.2.

Finally, the UE derives a combined TPC command, TPC_cmd, as a function γ of all the N soft symbol decisions W_i:

- TPC_cmd = γ (W_1, W_2, … W_N), where TPC_cmd can take the values 1 or -1.

The function γ shall fulfil the following criteria:

If the N TPC_i commands are random and uncorrelated, with equal probability of being transmitted as "0" or "1", the probability that the output of γ is equal to 1 shall be greater than or equal to $1/(2^N)$, and the probability that the output of γ is equal to -1 shall be greater than or equal to 0.5. Further, the output of γ shall equal 1 if the TPC commands from all the radio link sets are reliably "1", and the output of γ shall equal –1 if a TPC command from any of the radio link sets is reliably "0".
https://www.etsi.org/deliver/etsi_ts/125200_125299/125214/06.11.00_60/ts_125214v061100p.pdf

Unless otherwise specified, in every slot during compressed mode the UE shall adjust the transmit power of the uplink DPCCH with a step of Δ_{DPCCH} (in dB) which is given by:

Transmission power
$\boxed{\Delta_{DPCCH}} = \Delta_{TPC} \times \boxed{TPC\_cmd} + \Delta_{PILOT}$.
Transmission power control bits

At the start of the first slot after an uplink or downlink transmission gap the UE shall apply a change in the transmit power of the uplink DPCCH by an amount Δ_{DPCCH} (in dB), with respect to the uplink DPCCH power in the most recently transmitted uplink slot, where:

$\Delta_{DPCCH} = \Delta_{RESUME} + \Delta_{PILOT}$.

https://www.etsi.org/deliver/etsi_ts/125200_125299/125214/06.11.00_60/ts_125214v061100p.pdf
</td></tr>
<tr><td>said mobile station apparatus determining</td><td>The accused product practices determining transmission power based on said transmission power control bits (e.g., bits of TPC_cmd).</td></tr>
</table>

transmission power based on said transmission power control bits.	5.1.2.2.1.2 TPC command generation on downlink during RL initialisation When commanded by higher layers the TPC commands sent on a downlink radio link from Node Bs that have not yet achieved uplink synchronisation shall follow a pattern as follows: If higher layers indicate by "First RLS indicator" that the radio link is part of the first radio link set sent to the UE and the value 'n' obtained from the parameter "DL TPC pattern 01 count" passed by higher layers is different from 0 then : - the TPC pattern shall consist of n instances of the pair of TPC commands ("0" ,"1"), followed by one instance of TPC command "1", where ("0","1") indicates the TPC commands to be transmitted in 2 consecutive slots, - the TPC pattern continuously repeat but shall be forcibly re-started at the beginning of each frame where CFN mod 4 = 0. *ETSI* **3GPP TS 25.214 version 6.11.0 Release 6 16 ETSI TS 125 214 V6.11.0 (2006-12)** else - The TPC pattern shall consist only of TPC commands "1". The TPC pattern shall terminate once uplink synchronisation is achieved. https://www.etsi.org/deliver/etsi_ts/125200_125299/125214/06.11.00_60/ts_125214v061100p.pdf

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Finally, the UE derives a combined TPC command, TPC_cmd, as a function γ of all the N soft symbol decisions W_i:

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The function γ shall fulfil the following criteria:

If the N TPC_i commands are random and uncorrelated, with equal probability of being transmitted as "0" or "1", the probability that the output of γ is equal to 1 shall be greater than or equal to $1/(2^N)$, and the probability that the output of γ is equal to -1 shall be greater than or equal to 0.5. Further, the output of γ shall equal 1 if the TPC commands from all the radio link sets are reliably "1", and the output of γ shall equal –1 if a TPC command from any of the radio link sets is reliably "0".

https://www.etsi.org/deliver/etsi_ts/125200_125299/125214/06.11.00_60/ts_125214v061100p.pdf

Unless otherwise specified, in every slot during compressed mode the UE shall adjust the transmit power of the uplink DPCCH with a step of Δ_{DPCCH} (in dB) which is given by:

Transmission power

$$\boxed{\Delta_{DPCCH}} = \Delta_{TPC} \times \boxed{TPC\_cmd} + \Delta_{PILOT}.$$

Transmission power control bits

At the start of the first slot after an uplink or downlink transmission gap the UE shall apply a change in the transmit power of the uplink DPCCH by an amount Δ_{DPCCH} (in dB), with respect to the uplink DPCCH power in the most recently transmitted uplink slot, where:

$$\Delta_{DPCCH} = \Delta_{RESUME} + \Delta_{PILOT}.$$

https://www.etsi.org/deliver/etsi_ts/125200_125299/125214/06.11.00_60/ts_125214v061100p.pdf

4.3.1 Channelisation codes

4.3.1.1 Code definition

The channelisation codes of figure 1 are Orthogonal Variable Spreading Factor (OVSF) codes that preserve the orthogonality between a user's different physical channels. The OVSF codes can be defined using the code tree of figure 4.

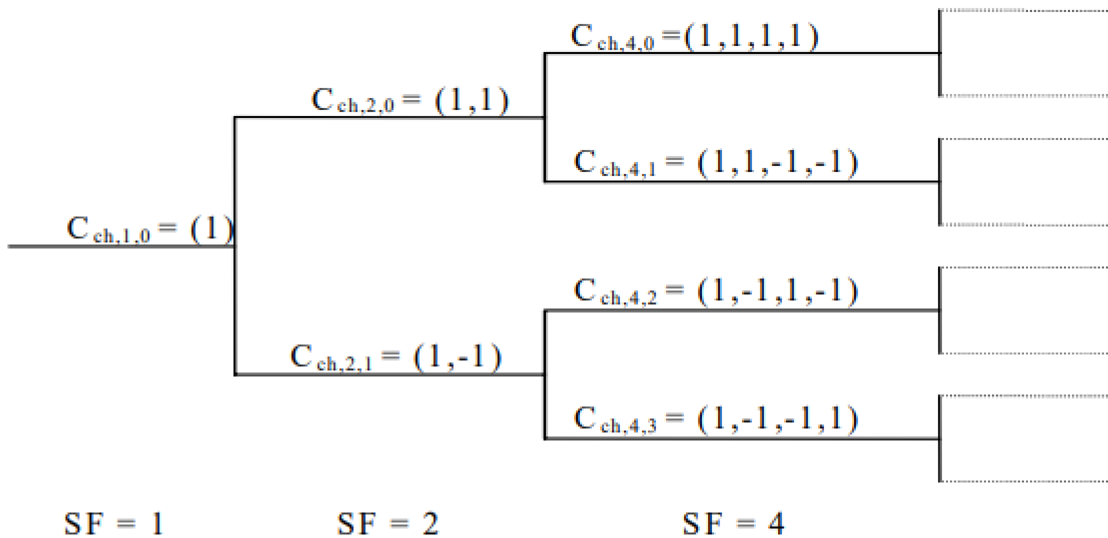

Figure 4: Code-tree for generation of Orthogonal Variable Spreading Factor (OVSF) codes

https://www.etsi.org/deliver/etsi_ts/125200_125299/125213/06.00.00_60/ts_125213v060000p.pdf